

SCIENCE STARS:

Student projects affecting you!

FROM BATH WATER TO FUEL

By Kelly Moynihan, journalism '08

CARTER DODD (CAP '08) IS WORKING ON A fusor, a device to create nuclear fusion. During the process of fusion, atoms are smashed together in a vacuum chamber by a power source so that they fuse and release energy. However, less power is released from fusing atoms than the amount of power it takes to cause fusion.

"If you use a 600-watt power supply, the amount of power you get out of fusion will be a thousandth or a millionth of that power," Dodd said. "I just want to get fusion to happen."

Dodd contacted his physics professor, Nathan Harshman, about the project and they, along with Professor Jean Pierre Auffret, have been working together on the initial stages of the experiment.

The team first plans to test its experiment on a smaller scale to see whether it will work and then, if successful, expand it. Dodd hopes to have a power source of 30,000 volts; fusion can begin to occur at 10,000 volts.

Though fusion is an inefficient source of power in terms of the power used versus the power produced, it can occur from a variety of power sources as long as they have atoms.

"Efficiency doesn't really have anything to do with it; it's just that there is so much energy there," said Dodd. "You can have a tub of water and use it as fuel because it's the atoms themselves that contain the energy. You don't need a chemical like natural gas."

Dodd plans to use deuterium, an isotope of hydrogen whose nucleus contains a neutron that will be released during fusion, which will let Dodd detect the process occurring.

However, Dodd has been unable to start his experiment because of lack of funding. He estimates all his supplies will cost \$4,000 but he has received only about \$1,000 so far for his project. Dodd is considering seeking grants to fund his research. He hopes his proposal will be approved shortly and that the first steps of his experiment can begin in the next few months. He plans for his experiment to occupy the rest of his time at American University and is hopeful that the experiment will work.

"If I do it right it will work," Dodd said. "Other people have done this successfully."

Dodd has attempted other research as well at AU. In December 2004, he succeeded in executing the reverse sprinkler, a physics puzzle that explores what would happen if a sprinkler sucked water in instead of spewing water out.

Before enrolling at AU, Dodd attended the Arkansas School of Math and Science for two years of his high school education. "I've always been science oriented," he said.

LEARNING IN THE DARK: THE MADISON CAVE ISOPOD PROJECT

By Amanda Hoffman, journalism '07

IN DARK CAVES, DEEP BENEATH THE Shenandoah Valley, **Ben Hutchins (BIO '07)** is searching for a small aquatic species that survived millions of years after losing its original ocean home.

This ancient species is the Madison Cave Isopod (MCI) or *Antrolana lira*. Thought to exist only in Madison's Cave in the Shenandoah Valley of Virginia and West Virginia, this distant relative of the pill bug was later found living in underground lakes in about 12 other locations in the region.

This isopod's ancestors are marine animals, leaving scientists to theorize that when sea levels dropped millions of years ago, MCIs were stranded in these caves, in pools of saltwater that, over time, became fresh water.

But after millions of years of cave dwelling, MCIs have made cave biologists wonder if these separate Shenandoah populations could still be genetically connected in terms of gene flow via reproduction or if time has isolated them from one another.

Hutchins, 23, a graduate student at American University, is on the path to finding the answers through his work on the Madison Cave Isopod Project.

Hutchins' love for the outdoors and animals led him to get his bachelor's degree in biology at Western Kentucky University, where he was first exposed to caves.

"I started caving as a pastime because caves are everywhere around Western Kentucky, which is only about 30 minutes from

Mammoth Cave, the largest cave in the world," Hutchins said.

After graduation, he headed to American University, where two of the few cave biologists in the country are professors, namely Daniel Fong and Dave Culver.

Hutchins' research began in the spring, with Fong and David Carlini collecting MCI from different Shenandoah locations. Back in the lab, they look at the sequences of the gene cytochrome oxidase I (COI), often used to detect the genetic similarities or differences within a species.

Collected MCIs are preserved in the lab in 95 percent ethanol and then a small piece is removed for DNA sequencing. According to Hutchins, the more differences in the COI gene sequence of two MCIs, the more likely the two have been reproductively isolated and are separate populations.

"It's kind of tricky because no one has sequenced DNA for the MCI," Hutchins said. "We have to tweak the protocol to make it work."

Collecting MCIs can be tricky for the unprepared or inexperienced.

To reach them, the team lowers bait, such as raw shrimp, down into drilled wells and hopes to catch something. The drilled wells are too small for people to enter, although they can run very deep. Despite the bait, the MCIs don't always turn up.

"That means that we have to take lots of trips to these caves and wells and spend lots of time on our hands and knees searching through the water, turning over rocks, and getting real wet," Hutchins said.

Helmets, lights, ropes, and climbing gear are essential for maneuvering into the caves, which, according to Hutchins, are prone to floods, uneven terrain, and vertical drops.

Hutchins hopes the project will provide valuable information about population structure, subterranean gene flow, and habitat discontinuity barriers the MCI face.

However, MCI research is only the beginning for Hutchins.

"There are lots of cave animals out there that we know nothing about and haven't even discovered yet," he said. "There is also a big need for education about and conservation of caves and cave animals."